

XIX. *An Account of the Construction and Verification of a Copy of the Imperial Standard Yard made for the Royal Society. By Captain HENRY KATER, F.R.S.*

Read May 19, 1831.

THE Royal Society having done me the honour to request that I would undertake the construction and verification of a copy of the Imperial Standard Yard for their use, it becomes necessary to place upon record the manner in which this was executed, in order that some judgement may be formed of the degree of confidence which may be placed in the result.

The scale in question is constructed in the manner which I have described in the Philosophical Transactions for 1830 \* for diminishing the errors arising from the thickness of the bar upon which it has hitherto been customary to trace the divisions. The support of the scale is of brass, forty inches long,  $1\frac{3}{4}$  inches wide, and  $\frac{6}{10}$ ths of an inch in thickness. A brass plate of seven hundredths of an inch thick was made to slide freely upon the support in a dovetail groove formed by two side plates, and was then fixed to the support by a screw passing through its middle.

This plate carries the divisions, which are fine dots upon gold disks let into the brass; the scale is divided into inches, and there is one inch to the left of zero, which is subdivided into tenths. The scale is the work of Mr. DOLLOND.

As the points designating the Imperial Standard Yard are upon a brass bar one inch in thickness, it was necessary to be extremely careful that the bar during the comparisons should be placed upon a surface as nearly as possible plane; since it has been shown in the paper before alluded to, that a curvature of which the versed sine is only one-hundredth of an inch in a yard would occasion a variation in the length of this standard amounting to nearly five-thousandths of an inch.

\* Page 359.

The marble slab formerly used was employed on the present occasion. Its surface was examined by means of a wire, the diameter of which was one-hundredth of an inch, stretched by a bow with a force of about four pounds; but as this wire would suffer a deflexion by its own weight amounting to about four-thousandths of an inch, a wire of two-hundredths of an inch diameter was placed at each extremity of the marble slab, and the wire of the bow resting upon these; the distance of its middle point from the surface of the marble was found to be a little less than two-hundredths of an inch, estimated by passing beneath it a wire of one-hundredth of an inch in diameter. The marble slab being sixty-four inches long, its surface may therefore, perhaps for the extent of a yard, be considered as sufficiently approximating to a plane; and I may here remark that no new adjustment of the slab was found to be necessary, as its position appeared to have undergone no change since my last measurements.

The scale was placed upon the marble slab near the Imperial Standard Yard, and the comparisons were always made about nine o'clock in the morning, in order to ensure as far as possible an equality of temperature in the scale and the Standard Yard. It will be seen that seldom more than three comparisons were taken on the same morning, lest the proximity of the person of the observer might destroy the equality of temperature.

The microscopic apparatus used on the present occasion is that which was employed in the comparison of various British standards of linear measure, an account of which is given in the Philosophical Transactions for 1821, and the mode pursued in making the comparisons was the same as that which I have there detailed. The value of one division of the micrometer is  $=.0000428742$  of an inch. As the microscopes invert, an increase in the readings indicates a corresponding deficiency in the length of the scale.

| Date.<br>1831. | Imperial<br>Standard Yard. | From 0 to 36<br>on the Royal<br>Society's Scale. | Difference.      | Difference in<br>Inches. |
|----------------|----------------------------|--|------------------|--------------------------|
|                | microm. readings.          | microm. readings.                                | div.             | inches.                  |
| April 5        | 46                         | 62 $\frac{1}{2}$                                 | 16 $\frac{1}{2}$ | .0007074                 |
|                | 48 $\frac{1}{2}$           | 61   | 12 $\frac{1}{2}$ | .0005358                 |
|                | 46                         | 59 $\frac{1}{2}$                                 | 13 $\frac{1}{2}$ | .0005787                 |
|                | 43                         | 59   | 16               | .0006860                 |
| P.M.           | 32                         | 45 $\frac{1}{2}$                                 | 13 $\frac{1}{2}$ | .0005787                 |
| 6              | 36                         | 53   | 17               | .0007288                 |
|                | 38 $\frac{1}{2}$           | 53   | 14 $\frac{1}{2}$ | .0006216                 |
|                | 37                         | 54   | 17               | .0007288                 |
|                | 39                         | 52   | 13               | .0005573                 |
| 7              | 26 $\frac{1}{2}$           | 43   | 16 $\frac{1}{2}$ | .0007074                 |
|                | 29                         | 44   | 15               | .0006431                 |
|                | 31                         | 44   | 13               | .0005573                 |
| 8              | 31                         | 47   | 16               | .0006860                 |
|                | 33 $\frac{1}{2}$           | 47   | 13 $\frac{1}{2}$ | .0005787                 |
|                | 34                         | 46   | 12               | .0005144                 |
| 9              | 51                         | 67   | 16               | .0006860                 |
|                | 51                         | 68   | 17               | .0007288                 |
|                | 52                         | 67   | 15               | .0006431                 |
| 10             | 43                         | 57   | 14               | .0006002                 |
| 11             | 35 $\frac{1}{2}$           | 53 $\frac{1}{2}$                                 | 18               | .0007717                 |
|                | 36                         | 54 $\frac{1}{2}$                                 | 18 $\frac{1}{2}$ | .0007931                 |
|                | 41                         | 52   | 11               | .0004716                 |
|                | 37                         | 51   | 14               | .0006002                 |
| 12             | 30                         | 45   | 15               | .0006431                 |
|                | 30                         | 46   | 16               | .0006860                 |
|                | 35                         | 44 $\frac{1}{2}$                                 | 9 $\frac{1}{2}$  | .0004072                 |
|                | 30                         | 44   | 14               | .0006002                 |
| 13             | 39                         | 55   | 16               | .0006860                 |
|                | 37 $\frac{1}{2}$           | 51 $\frac{1}{2}$                                 | 14               | .0006002                 |
|                | 36                         | 50   | 14               | .0006002                 |
| 14             | 17                         | 29   | 12               | .0005144                 |
|                | 16                         | 27 $\frac{1}{2}$                                 | 11 $\frac{1}{2}$ | .0004930                 |
|                | 7                          | 18   | 11               | .0004716                 |
| 15             | 86                         | 103 $\frac{1}{2}$                                | 17 $\frac{1}{2}$ | .0007502                 |
|                | 91                         | 106  | 15               | .0006431                 |
|                | 92 $\frac{1}{2}$           | 105  | 12 $\frac{1}{2}$ | .0005358                 |
| Mean .....     |                            |  |                  | .0006204                 |

It will be seen in the above Table that the greatest difference between any one of the thirty-six comparisons and the mean is less than two ten-thousandths of an inch; the distance from 0 to 36 on the Royal Society's scale may therefore be considered as equal to 35.99938 inches of the Imperial Standard Yard.